Airport Design

teacher guide

Introduction

This section begins by having students think as airport planners, answering questions like **Where Should A New Airport Be Located?** Students research local weather conditions, economic (census) data, geology, and other relevant information. Most of this information is gathered from web sites, compiled into charts and graphs, analyzed and referenced with other information, mathematically and graphically. Finally, the students establish where a new airport should be located.

In Activity II, students investigate the possible links between **Travel and the Spread of Disease**. They start by looking at historical outbreaks of diseases and their spread through travel and contact between infected and uninfected people. Modern diseases are also discussed, and students will look for possible links to travel trends. Finally, students have the opportunity to explore genetic diseases and how it is possible for diseases to be spread between species (Mad Cow Disease is an example).

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Activity I: Where Should A New Airport Be Located?

lesson overview

Materials: web access for small student groups, or data from weather, census, and USGS sites, maps (for geography of US, soil conditions), print resources on specific cities and states (optional)

Time for set-up: none (may take time to order / locate USGS soil maps)

Time for lesson:

Introduction = 15 minutes
Weather information = 45 minutes
Census information = 1 hour
Geology / Other = 45 minutes (with some out-of-class time)

Student Prerequisites: ability to use charts / databases, Internet navigation

Icons for recommended subject areas where activities could be used:

PRE, PHY (geology, weather), SS, ENG

Objectives:

* Students will practice using and calculating percents.
* Students will understand both sides of an argument and present logical conclusions.
* Students will understand the important components of a proof.
* Students will practice creating and analyzing bar and line graphs
* Students will discuss and learn about misleading aspects of data.
* Students will calculate basic statistical parameters including means.

Student Assessments: worksheets, calculations, bar graphs, pro/con or compare/contrast essay, listed or essay-form logical discussion, map, presentations, discussion

Activity I: Where Should A New Airport Be Located?

Part A - How do we choose where to build a new airport?

This may be used as a class discussion or individual warm-up. Ideally, weather conditions, business, military, tourist, and consumer need, economic ability, and space availability are mentioned.

1. _____

2. _____

3. _____

4. _____

5. _____

Part B - Select appropriate counties

Pick three non-adjacent counties where there are not commercial / international airports, but you think there should be, and write them here.

May want to mention bulleted points in part C before starting OR show an example such as that in C to students so that they can come up with reasons why information may be misleading / other data that should be considered and/or collected.

1. County: _____ State: _____

2. County: _____ State: _____

3. County: _____ State: _____

Activity I: Where Should A New Airport Be Located?

Part C - Weather

Weather is one of the most influential factors in flight delays, cancellations, and other problems. Determine the best county to have your airport in by collecting information from http://www.ncdc.noaa.gov/ol/climate/stationlocator.html

If web access cannot be obtained for the entire class, the teacher can print out information from the site and share it with the class. One successful comparison is between Benton, Jackson, and Marion Counties in Oregon. Simply summarizing the data in terms of number of events, deaths, injuries, property and crop damage, provides insight into where the best location for an airport would be.

County	# Events	Deaths	Injuries	Property Damage	Crop Damage
Benton	67	13	3	$408.4 M	$0
Jackson	45	0	0	$3.57 M	$2.1 M
Marion	8	0	7	$70 K	0

- It is notable that Marion county is home to the state capitol; surely first settlers to Oregon realized the importance of weather in establishing their capitol. (A social studies lesson here.)
- It should be noted that several parameters are excluded from discussion here, which may result in erroneous conclusions. Although the database appears to continuously provide information spanning the same time period, it should always be checked that one county does not have a longer or shorter span of recorded storm events than others, as this would certainly bias results. In addition, the varying economic and productive status of different areas surely influences the Property and Crop Damage costs. Lastly, different counties are differently populated and have different geographic sizes. Students should be wary of this from the start and choose similar states in as many aspects as possible.

1. Pick the county button and enter your county name, and the database should retrieve several weather stations in your area. Be careful! Sometimes a county name will occur in more than one state!

2. Pick any station in your county to retrieve data from as you will be retrieving county data, not city data.

Activity I: Where Should A New Airport Be Located?

3. Once the station data appears, scroll down the page and retrieve Storm Event data ("all possible storm events").

4. Fill in the charts on the following pages with what you find. Use one sheet for each county.
   - Be sure to show a key or legend somewhere with any acronyms or abbreviations you use, so someone else can read and understand your charts!
   - If there is an extensive list, summarize the events as best as possible.

For instance, I can put all Thunderstorm Wind (Tstm wind) records together, as follows:

Location	Month	Time	Type	Mag	Deaths	Injuries	Property Damage	Crop Damage
Corvalis, Philomath	9, 10	1400, 1600	Tstorm wind	N/A	0	1, 0	$20K, $0	$0

Activity I: Where Should A New Airport Be Located?

Name Date

County:

Location	Month	Time	Type	Mag	Deaths	Injuries	Property Damage	Crop Damage
Total # of Events: _____								

This table will be used three times, once for each county.

Activity I: Where Should A New Airport Be Located?

5. Evaluate your information by drawing a bar graph comparing the number of incidences and month of the year. Use different colored bars to show the different types of events.

Teacher can expand this research by assigning students to find records of precipitation, temperature, and wind speed, which also influence flight conditions. These are better recorded using a line graph. This data, taken over a number of years can give evidence of anomalies or aberrant weather patterns, which may bias the choosing of an airport site.

6. Almost any kind of storm provides reason for closing an airport. Which county is the best location for your airport? Create a response by listing the pros and cons of each site on another sheet of paper.

The teacher may provide a lesson here on different forms of arguments and proofs. Pro/Con is a very simple format with which most students are familiar, but a teacher may choose to challenge students by having them write their logic in 2- or 3- column proof form, by listing main steps of their "proof," or by writing a 3 paragraph essay.

If students are adept at such things, onecould have a debate (be sure to provide students with JUICY data that may contain misleading information; students might have to do extra calculations comparing population size, economic values, and area of state to weather data recorded).

7. Final decision:

_____ County, _____ is the best site for the airport.

Part D - Census Data

Use census information from http://www.census.gov to fill out the following chart for the single county you picked. Most of this information will be a part of the economic census and income and poverty estimates. If the information is not available, write "N/A."

Census Population Data

	Location (Latitude & Longitude)	Population for year: _____	% Pop. Change since prev. year	% Poverty Estimate	Median Household Income
County					
State					
USA					

Activity I: Where Should A New Airport Be Located?

Name Date

County Census Economic Data

	Type of Business	Number Established	Sales ($ million)	No. of Jobs	Output per Capita	Jobs/1000 pop. (% of state)	Jobs/1000 pop. (#)	Establishments per 100K pop. (% of state)
County								
State								
USA								

Activity I: Where Should A New Airport Be Located?

Part E - Evaluation

Evaluate the information from the County Census data tables.

1. If the governor were to evaluate your decision to place an airport in this county, would he or she agree with your idea?

   List 3 reasons why:

   a) _____

   b) _____

   c) _____

2. Would he or she disagree?

   List 3 reasons why:

   a) _____

   b) _____

   c) _____

Activity I: Where Should A New Airport Be Located?

3. If the president were to evaluate your decision to place an airport in this county, would he or she agree with your idea?

List 3 reasons why:

a) _____

b) _____

c) _____

4. Would he or she disagree?

List 3 reasons why:

a) _____

b) _____

c) _____

Activity I: Where Should A New Airport Be Located?

Part F - Let's decide where in your county the airport should go.

The governor and president advise you to consider (a) funding, (b) geology / soil type, (c) vacant land space, and (d) tourist attractions.

Funding: Use http:www.census.gov to determine the top 3 towns in the county. This information should be found at the bottom of the page for economic census information of the county you picked.

Business Income Data

City or Town	Population	Business	# of Businesses Established	Sales ($/yr)
1.		Retail		
		Wholesale		
		Services		
2.		Retail		
		Wholesale		
		Services		
3.		Retail		
		Wholesale		
		Services		
Mean		Retail		
		Wholesale		
		Services		

Check with your teacher to see if more statistical analysis is required.

Activity I: Where Should A New Airport Be Located?

Use the data from the Business Income Data table to calculate the following:

Mean Business Income

City or Town	Retail		Wholesale		Services	
	$ Produced/ person	# Estab./ person	$ Produced/ person	# Estab./ person	$ Produced/ person	# Estab./ person
1.						
2.						
3.						
Mean						

Create a bar graph to illustrate the above information, in order to help you make your decision about which city to pick.

There are several trends regarding successful placement of airports and businesses. For instance, it was recently noted that wherever shipping companies set up shop, other businesses and prosperity followed! Hence, such businesses mark the spot for potential airports. In order to teach research, interviewing, and statistical skills, the students could research this trend or related trends.

Activity I: Where Should A New Airport Be Located?

Part G - Geology/Soil Type

Geology is important for construction of airports for a variety of reasons. Most importantly, one does not want to construct an airport on seismically active areas, nor does one want to construct an airport on unstable or marshy ground.
This would be a perfect place to review Earthquake safety procedures and the waves produced by earthquakes. Several guides are available that discuss soil type and its stability rating with respect to earthquakes. In addition, there are several databases that will list earthquakes that have occurred or occurred recently (University of Texas has a real-time earthquake site link). Looking at database information, student statisticians could get an idea of the likelihood of earthquakes in the region and/or the amount of damage anticipated from one.

Use http://www.usgs.gov to investigate soil types and earthquake-prone regions. Click on "USGS by State" to obtain the appropriate state information. You can then narrow your search if necessary by using key words.

Some maps are slow to download, as they are quite large, and some maps are not available on the web page. Most USGS maps may be easier to obtain through a USGS state office or a college or university that has a mapping-related department.

Depending on resources used, the teacher can direct students to

- create a map of their area, with soil types and their potential uses at the airport,
- create a chart showing frequency of earthquakes per region, then calculate probability of future earthquake occurance.
- establish number ratings for different soil types, calculate land values using the mean of these numbers and area covered by these soil types, then finally rate a few potential sites, relative to each other.
- write an essay or outline a logical discussion, indicating where one should / should not build certain airport features.

Part H - Other Factors

Use an encyclopedia, map, and/or other information to get an idea of the other topics (land space, commuter access, and tourist attractions), to help make your decision.

The airport will be in _____, and will be located in the region shaded on the attached map.

This town was chosen for the following reasons:

1 _____

2. _____

3. _____

Have the students compete with each other for airport–building contracts; this portion of the project can be topped off with student presentations before a panel of adults or students who can decide which place is best, based on student presentations. Students should be required to explain any calculations, as they proceed. Such a competition could be made more difficult by having a limit on the cost of land (of a pre-specified area) to be used in the project; this may eliminate very prosperous and expensive areas and force students to think of pros to less exclusive regions.